

Occupational and Environmental Hazards Associated with Lung Cancer

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Jöckel K-H (Bremen Institute for Prevention Research and Social Medicine (BIPS), Grünenstrasse 120, D-2800 Bremen 1, FRG), Ahrens W, Wichmann H-E, Becher H, Bolm-Audorff U, Jahn I, Molik B, Greiser E and Timm J. Occupational and environmental hazards associated with lung cancer. *International Journal of Epidemiology* 1992 21: 202-213.

In a hospital-based case-control study 194 lung cancer cases, 194 hospital controls, and 194 population controls were interviewed for their smoking, occupational, and residential history by trained interviewers, using a standardized questionnaire. In order to include many different environmental exposures, case ascertainment took place in seven different hospitals with catchment areas ranging from rural to highly industrialized.

Lung cancer risk strongly increases with cumulative cigarette dose, reaching an odds ratio (OR) of 16.19 (95% confidence limits (CL): 5.10, 51.33) for male smokers of more than 40 pack-years and an OR of 19.99 (95% CL: 4.98, 80.24) for female smokers of more than 20 pack-years.

For the quantification of occupational exposure to known carcinogens of the lung a novel approach was developed which accumulates exposure information obtained by supplemental questionnaires through an automatic procedure. The OR for the highest exposure group in males was 2.7 (95% CL: 1.23, 5.78). Significantly increased risks were observed in the metal industry, particularly in smelter and foundry workers (OR 4.8, 95% CL: 1.15, 20.16) and in turners (OR 2.2, 95% CL: 1.05, 4.75). In the construction industry the risks were particularly high in road construction workers (OR 3.7, 95% CL: 1.05, 13.20) and in unskilled construction workers (OR 2.7, 95% CL: 1.24, 5.76). The risks in these occupational groups increased with duration and with latency.

Quantification of air pollution was done on a county basis by time period. An index based on emission data for sulphur dioxide was compared to a semiquantitative index, which included additional information on ambient air pollution. After adjustment for smoking and occupational exposures an OR of 1.01 (95% CL: 0.53, 1.91) for an emission index and of 1.16 (95% CL: 0.64, 2.13) for a semiquantitative index was obtained.

Regional comparisons of mortality figures show pronounced differences for lung cancer in urban versus rural areas.^{1,2} After adjusting for tobacco smoking and occupational hazards most of the differences can be explained by these factors. However, a contribution from ambient air pollution was also identified in some case-control studies. In Erie County (New York) Vena³

classified air pollution into three categories on the basis of total suspended particulates (TSP). He found a crude odds ratio (OR) of 1.56 for people who had lived in highly and intermediately polluted areas for more than 50 years. After adjusting for age, smoking, and occupational exposure this risk was reduced to 1.26 (not significant). An increased risk of lung cancer was also observed in several studies after adjustment for smoking and occupational exposure. Brown *et al.*⁴ described a 60% increased lung cancer risk for those living close to a zinc smelter in Pennsylvania which emitted arsenic and cadmium compared to a reference area. In Sweden, Pershagen⁵ found an OR of 2 for people living close to a copper smelter which emitted arsenic, and Jedrychowski *et al.*⁶ observed an OR of 1.42 for the highest air pollution exposure level in males in Cracow (Poland). In China a close association was found between lung cancer mortality and indoor burning of 'smoky' coal in regions which showed an increased mortality of lung cancer in females.⁷

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